NASA Science Mission Directorate - Applied Sciences Program

Agricultural Efficiency – Fiscal Year 2005 Annual Report [*]

SUMMARY

The Agricultural Efficiency program element, through the NASA partnership with the USDA Foreign Agricultural Service (FAS), achieved significant accomplishments in 2005. The program completed a benchmark report documenting the improvements from NASA Earth science research to the FAS PECAD/CADRE (Production Estimates and Crop Assessment Division / Crop Condition Data Retrieval and Evaluation) decision support tool and initiated the operational transfer of the lake and reservoir height capability (benchmarked in 2004) from NASA to FAS. The Agricultural Efficiency team also completed a verification and validation report for the MODIS products delivered to FAS.

The benchmark report on PECAD/CADRE included application of a unique tool – Defect Detection and Prevention (DDP) – to quantify the reduction in risk in FAS crop production and yield estimates with the addition of NASA Earth observations data products (MODIS vegetation condition, crop area, etc.) and model results. The collaboration between NASA and USDA includes major contributions from NASA Centers (Goddard, Jet Propulsion Laboratory, and Stennis) and the Universities of Arizona, Maryland and Missouri. The collaboration will continue in 2006, and the program expects to achieve a major milestone with the benchmark report for the precipitation and soil moisture products.

The Agricultural Efficiency program element expanded its scope in 2005 with the selection of projects that will extend further the reservoir and lake monitoring activity and focus more explicitly on soil moisture products from AMSR-E data and other sources. These projects will enhance the FAS decision support tools. In FY05, the program will also support an exploratory project led by the Goddard Institute of Space Studies (GISS) extending NASA global climate models (GCM) to enhance U.S. Agency for International Development (USAID) decision tools to predict within-season growing conditions in Central and South America.

MAJOR ACCOMPLISHMENTS

Integrating NASA Earth Science Data into Global Agricultural Decision Support Systems

In FY05, the project team completed fieldwork in Oklahoma and Argentina for verification and validation of a climate-based crop yield model. The project team also developed and evaluated products for precipitation and MODIS surface reflectance, completed a preliminary version of a Web portal and Agricultural Information System (AIS), adapted the project to take advantage of evolving technology, and began integrating the NASA products into FAS and the United Nations World Food Program (UN/WFP).

In FY06, the project team expects to complete a benchmark report on the impact of the climate-based crop model on FAS decision support tools. FAS plans to complete an operational AIS, incorporating precipitation and MODIS data, to provide a reusable system adaptable for other USDA agencies. The team will develop a Web portal to make project results available to a wide audience.

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[*] The FY05-09 Agricultural Efficiency Program Element Plan is available through: *http://aiwg.gsfc.nasa.gov/dss.html*

Integrating NASA Models and Missions into Climate and Agriculture Decision Support Tools
This project began in FY05, and the project team configured and ran current climate simulations using GISS GCM ocean temperature data. The team defined statistical relationships of climate teleconnections, such as El Niño/Southern Oscillation (ENSO), the North Atlantic Oscillation (NAO), Arctic Oscillation, and the Pacific/North American (PNA) pattern. The project team ran climate change scenarios with the GISS GCM and projected how ENSO interactions may change with climate change. The project team also worked with USAID to develop a week-long scoping mission, established extensive in-country contacts, and set up a baseline evaluation of relevant regional agricultural decisions.

In FY06, the project team will conduct a scoping mission to Uruguay and Central America to strengthen connections with the decision support system users and to better understand the data and database needs of the user groups.

Support of Application of NASA EOS MODIS Data by USDA Foreign Agricultural Service
In FY05, the project team expanded global coverage of near real time MODIS Rapid Response (RR) data; prototyped a RR Vegetation Index (VI) composite product; developed a global, flexible, interactive crop-likelihood mask and a vegetation moisture stress index; enhanced the database management system to improve system response time, robustness, and usability; developed a calibrated NOAA-AVHRR vegetation index; and, prototyped a 7-2-1 band combination of 16-day MODIS composite data to enhance Database Management System (DBMS) analysis capabilities.

In FY06, the project team will develop the rolling VI composites to enable more frequent and timely delivery of VI to FAS. The project team will also design and begin to implement the FAS production system at NASA-Goddard, and it will test and validate the flexible crop mask and vegetation moisture stress index developed in FY05.

SOLICITATIONS

Decisions CAN
The Agricultural Efficiency program element received 33 Step-1 proposals in the Decisions CAN and encouraged 22 to submit full proposals. In Step-2, the Agricultural Efficiency program element received 23 full proposals. Following the panel reviews and internal assessment for programmatic balance, the Applied Sciences Program selected the following Agricultural Efficiency proposals for awards:

> Integrating MODIS and VIIRS NPP Observations into the USDA FAS Decision System
> *PI: Christopher Justice, University of Maryland–College Park*
>
> Integrate NASA's Global Soil Moisture Remote Sensing and Modeling Data into USDA's Global Crop Production Decision Support System
> *PI: Xiwu Zhan, University of Maryland–Baltimore County (since moved to USDA)*

The program selected the following proposals for a single, combined project serving the Agricultural Efficiency, Public Health, and Disaster Management program elements:

> Integrating NASA Earth Science Results into Malaria Early Warning Products to Enhance USAID Food Security and Disaster Management Decision Making
> *PI: James Verdin, USGS EROS Data Center*
>
> Enhancing the Famine Early Warning System Network Decision Support System with NASA Earth System Science Data and Modeling Results
> *PI: Molly Elizabeth Brown, NASA Goddard Space Flight Center*

The Applied Sciences Program later selected additional proposals for one-year awards from a Congressionally-directed augmentation, including two projects for the Agricultural Efficiency portfolio:

> Enhancement and Expansion of the Near-Real Time Lake and Reservoir Monitoring System
> *PI: Charon Birkett, NASA Goddard*
>
> Improving the RUSLE Model Using Remotely Sensed Crop Residue Maps
> *PI: Susan White, Institute for Technology Development*

ROSES 2005 – Section A.24

For the Applied Sciences portion of the ROSES 2005 NRA, the Agricultural Efficiency program element received 11 Step-1 proposals and encouraged 7 to submit full proposals. The Step-2 proposals were due in November 2005 with selections expected by April 2006.

PUBLICATIONS (SELECTED)

Rosenzweig, "Agriculture and Climate Change: Mitigation and Adaptation. Special Issue 'Challenges in Integrating Mitigation and Adaptation as Responses to Climate Change'" (*Mitigation and Adaptation*, in press; 2005).

Rosenzweig, "Consortium for International Earth Science Information Network (CIESIN) and Socio-economic Data and Applications Center (SEDAC)" (User Working Group; 1993-2004).

Rosenzweig, "Data and Scenarios for Research on Observed Changes in Systems and Sectors. Discussion Paper" (IPCC Task Group on Climate Impact Assessment; 2005).

Rosenzweig, "Effects of climate change on weather and water" (*Environmental Management*, in press; 2005).

Rosenzweig, "Developing synthesis tools for an international program on adapting to climate variability and change: The AIACC Data, Methods, and Synthesis Project" (AIACC Synthesis. In Leary, N. (Ed.) *AIACC Project Book*, in preparation; 2005).

Rosenzweig, "Global Warming" (*Perspectives in World Food and Agriculture*. Vol. 2. The World Food Prize; 2005).

Rosenzweig, "Water resources for agriculture in a changing climate: International case studies" (*Global Environmental Change* 14:345-360; 2004).

Rosenzweig, "Desertification" (*Encyclopedia of Soils in the Environment*. Elsevier. Oxford, UK. pp. 382-389; 2005).

Rosenzweig, "Climate Change and Agricultural Pests." In Epstein, P. (Ed.). *Climate Change Futures: Confronting Risks, Emerging Opportunities*. A Report of: Climate Change Futures: Health, Ecological and Economic Dimensions" (Center for Health and the Global Environment. Harvard Medical School. Swiss Reinsurance Company. United Nations Development Programme. Cambridge, in press; 2005).

Rosenzweig, "Climate Change, Agriculture, and Development. Incorporating Climate Change into Development Project Planning: Guidance for USAID" (USAID; 2005).

Rosenzweig, "Climate Change and Greenhouse Gas Mitigation: Challenges and Opportunities for Agriculture" (Task Force on Agriculture's Response to Global Climate Change; 2005).

CONFERENCE/WORKSHOP PRESENTATIONS (SELECTED)

Kempler, "Multi-Sensor Distributive On-line Processing, Visualization, and Analysis Infrastructure for an Agricultural Information System at the NASA Goddard Earth Sciences DAAC" (AGU; Dec. 2004; San Francisco).

Kempler, "An Interoperable, Agricultural Information System Based on Satellite Remote Sensing Data" (ASPRS; Mar. 2005; Baltimore), Comparison of Daily Rainfall from Multi-Satellite Precipitation, Air Force Weather Agency and Mesonet Gauge Analyses Over Oklahoma for Crop Yield Monitoring" (IAMAS; Aug. 2005; Beijing).

Rosenzweig, "Assessment of Observed Changes in Natural and Managed Systems" (*Semester in Environmental Science Distinguished Scientist Seminar*; September 16, 2005; Woods Hole, MA).

Rosenzweig, "Heat is On: Present & Future Impacts of Global Warming" (*Cold Spring Harbor Laboratory; Cultural Series*; May 31, 2005; Cold Spring, Long Island, NY).

Rosenzweig, "Climate Change Impacts: Regional, National, and Global Scales" (*Integrated Program on Global Change Public Lecture Series*; The Environmental Institute; 2005; University of Massachusetts, Amherst, MA).

Rosenzweig, "Energy, Agriculture, and Health: Links to IPCC" (*CLIVAR 2004 Program*; June 24, 2004; Baltimore, MD).

CONTACT INFORMATION

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